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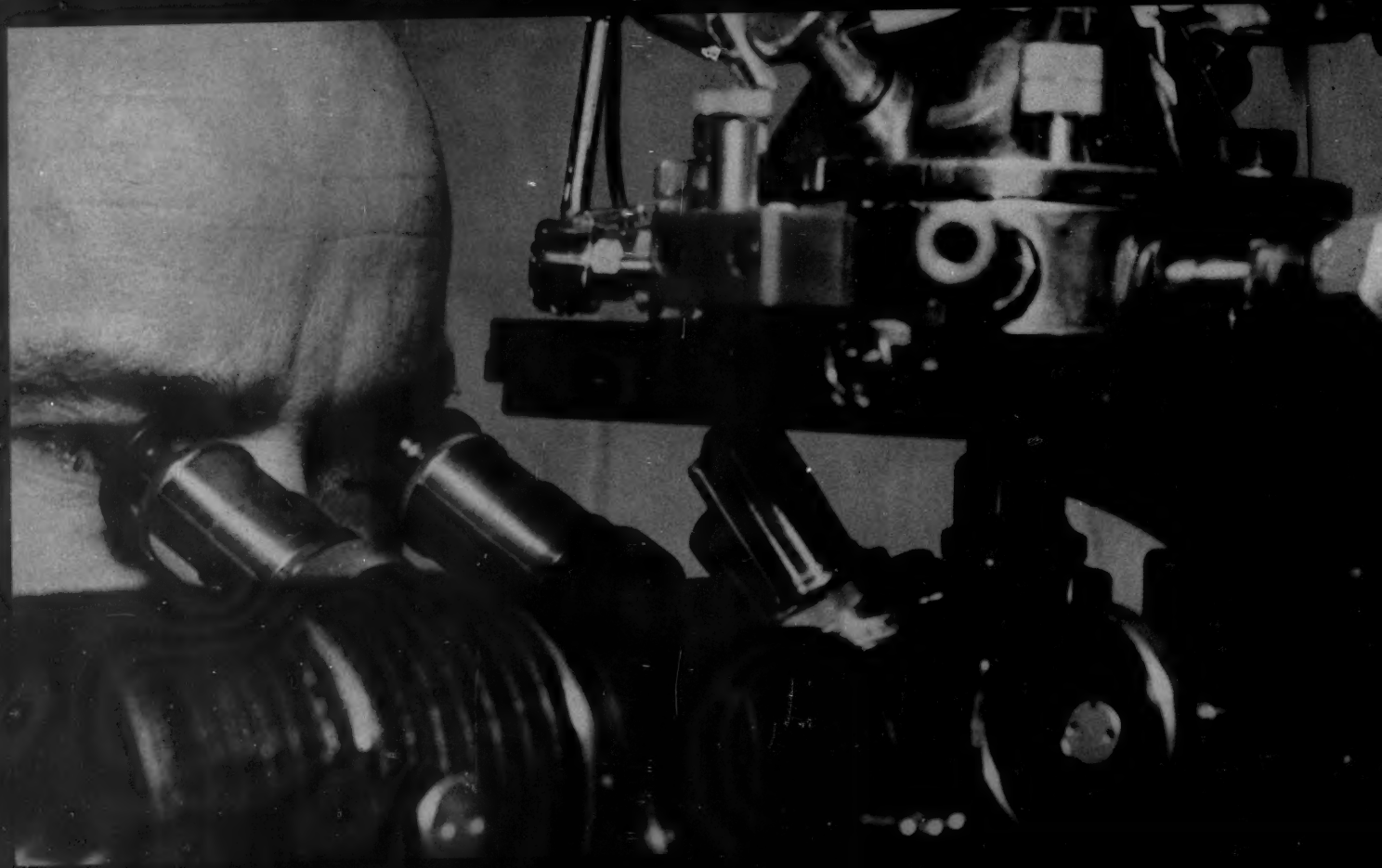
R E S E A R C H

E N G I N E E R

OCTOBER, 1961

A Special
Research
Report

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The Cover

At Tech's ceramics' branch in Chamblee, Georgia, a researcher watches a simulated nose cone being tested in a fiery 10,000-degree blast of a gas spray using an electric arc.

The Staff

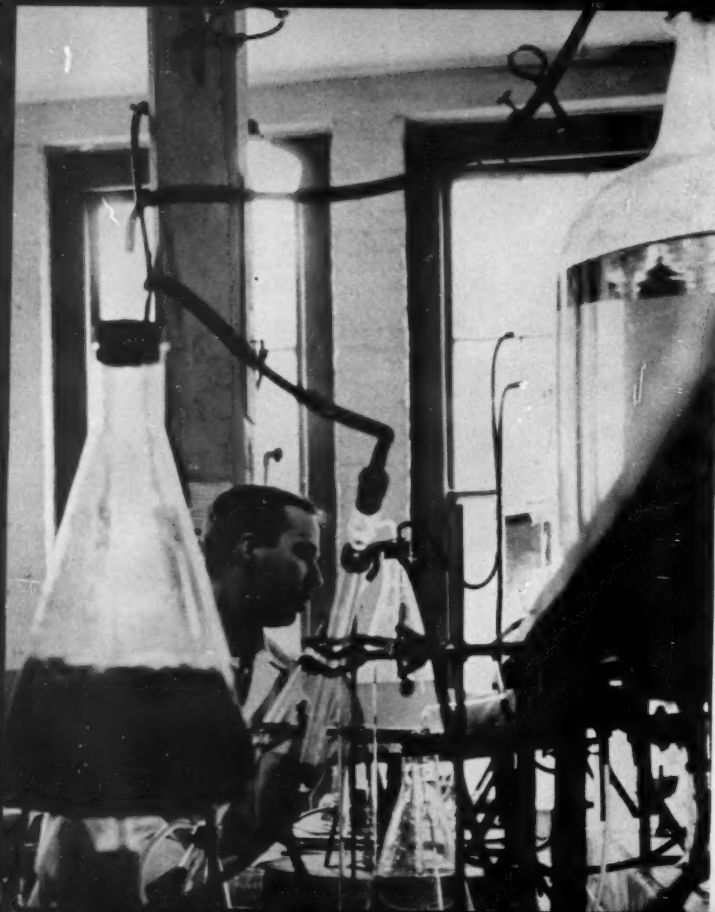
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Research:

THE GEORGIA TECH Engineering Experiment Station has just completed another year of growth—its seventh.

Research volume for the 1960-61 year passed the \$4 million mark, thus doubling itself in the past four years.

Growth has been noted in many areas—in capabilities of the staff, in contributions to science and in service to the Institute, to the State and the Nation. This growth offers the key to progress.

A survey of Tech's work over the past year should be more than a collection of figures on dollar volume, equipment added, additions to the staff and services performed. Of course, these things must be included. When the old year has been outlined, sifted into its statistical form, there comes a time for looking forward to the challenges of tomorrow. It is a time for introspection, for comparisons, for seeking the means to meet new challenges.

4 / *research engineer*

Key to Progress

INTROSPECTION

The coming year will mark yet another great step forward for Georgia Tech with the addition of the Nuclear Research Center. Now under construction, it is scheduled for completion late in 1962. Its total value will be about \$4.5 million. Another building block in the modern concept of Georgia Tech, it will serve to strengthen the role played by Tech in research, in education and the progress of mankind.

Here is a fine example of growth. But in introspection, what will conditions be in the Nuclear Research Center five years from now?

For in fashioning a key to progress and increasing its growth, the Station has not been without obstacles. Total dollar volume increase in research effort was almost \$300,000 bringing accrued income to a record high of

\$4,066,000. The steadily increasing amount of activity brought 30 new members to the Station's staff. Several items of research equipment were added. Research programs provided services for 227 student assistants, 80 graduate assistants and 88 faculty research associates.

It is a paradox that the amount of working space remains virtually static. Already crowded facilities are being pressed into service beyond any reasonable limit. Will this same statement be applied to the Nuclear Research Center a few years after it goes into service?

The past year might be termed one of "restricted growth." This can be attributed in the main to a lack of working space. On almost every hand needs of operating interdepartmental facilities continue to be critical.

In order to remain in financial health and to keep abreast of the times, it has been estimated that the Station should double its research volume every four years. The increase in volume of research last year would have been much higher had adequate physical facilities been available.

COMPARISONS

A greater potential for contributions to better serve Georgia and provide new opportunities for its people is

found at Georgia Tech. This potential is being endangered by mere physical limitations.

In comparing ourselves with research institutions in other states, we find many of the others have used their potential more wisely. They have provided both the facilities and motivations for vigorous economic and industrial development and have attracted and generated additional research-oriented industrial activity.

In the Boston area, the presence of research facilities at Massachusetts Institute of Technology has been instrumental in attracting more than 200 research laboratories and manufacturing firms to industrial sites in the past eight years. This represents a total capital investment of approximately \$140,000,000 and employment of almost 30,000.

More than 100 electronic firms have moved into the Palo Alto, Calif., area to be close to the supply of high quality technical personnel and to keep up on new developments in research at Stanford University and Stanford Research Institute.

North Carolina's net manufacturing employment gain since 1954 has been almost three times Georgia's total. Partially responsible for this growth has been research

efforts and promotional results of Research Triangle—a coordination of research facilities at Duke, the University of North Carolina and North Carolina State College.

Florida quadrupled Georgia's net manufacturing employment increase between 1954 and 1958. To further Florida's industrial progress, a \$5,000,000 industrial research center is being established at the University of Miami to provide industrial research facilities and to house advanced scientific laboratories of up to 30 major companies.

Tech, in its undergraduate and graduate schools, in its departmental research and in its Engineering Experiment Station, has the functioning nucleus to encourage the growth in Georgia that we see in other states. A bold and imaginative program and adequate facilities would provide the catalyst.

THE CHALLENGE

Georgia has numerous advantages, "lures," to offer industry. These include a favorable climate, abundant water supply, vast land areas for expansion and improving transportation facilities. Her mineral and forest resources are just beginning to be tapped.

But her most valuable resource, the talents and abilities

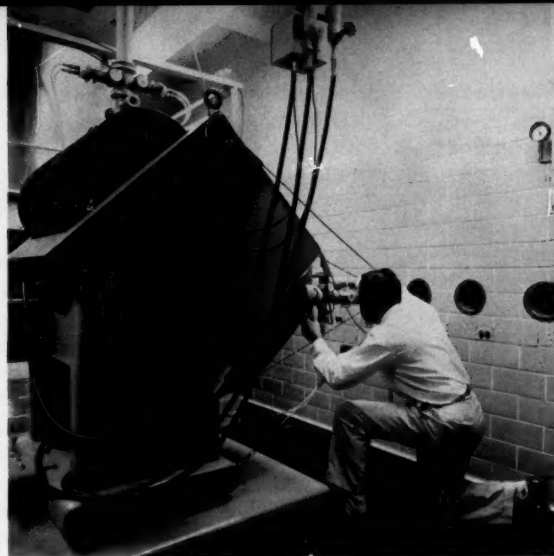
of her people, is being scattered into other states where new manufacturing jobs are available. To hold these people a substantial number of jobs must be created in "new type" industries which have not yet been attracted to Georgia in appreciable numbers. These new industries include electronics, chemicals, fabricated metals among others.

The disposable income of Georgia citizens is well below the U.S. average. To raise Georgia to the national level, it has been estimated that at least 15,000 new manufacturing jobs must be created per year over the next 25 year period. This is a tremendous challenge.

Tech, with the cooperation of the State's leaders, can help meet this challenge. If development efforts in Georgia continue at their present pace, the challenge is meaningless. Present station capabilities in the fields of industrial development, data processing, technical information service, product development and equipment and process design form the foundation for an effective program of industrial research and economic growth.

Much more is needed, however, before Georgia's pressing research needs can be adequately met, before new industry can be attracted.

The challenge cannot be met unless proper physical fa-



cilities are provided.

Research produces new knowledge. Knowledge creates new opportunities. In this way it is the key to progress. Progress cannot be realized unless the physical barriers are thrown down.

Research Areas



Wyatt C. Whitley, chief

CHEMICAL SCIENCES

THE CHEMICAL SCIENCES DIVISION continues to pursue projects of both state and national significance.

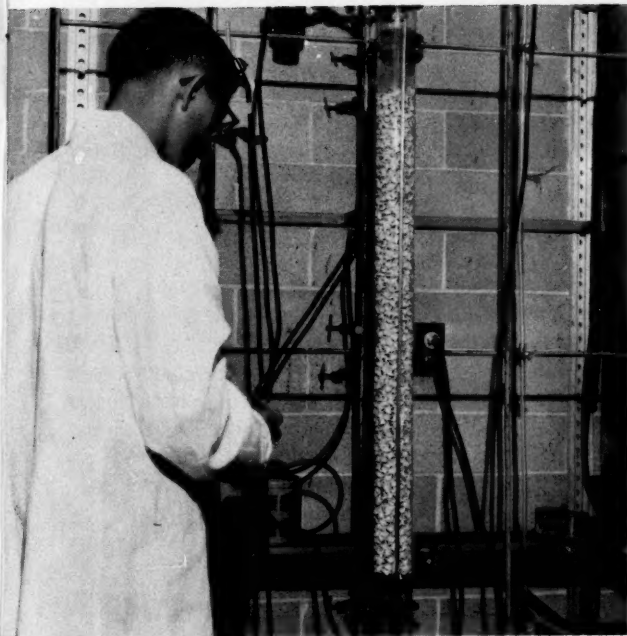
Important to Georgia are programs on the study of clays and the analysis of polluted streams and industrial wastes. Some projects of national emphasis are the use of radioisotopes in the determination of uniformity in mixing concrete and the use of radioisotopes in the development of better traffic paints. Still other projects have involved

catalysis, kinetics, corrosion, coatings, fine particles, naval stores, chemistry, plastics, paints, low temperature chemistry, solar distillation, physical properties at cryogenic temperatures, natural radioactivity in water supplies, textile chemistry and textile fibers.

Much work in the bioengineering branch has been directly related to public health. Included are the possible protection of surgical patients from staphylococcal infections, elucidation of the mechanisms of radiation damage which would aid in preventing or treating such damage in part of the larger study of the origins of cancer, and safeguarding and improving the quality of potable waters. The professional staff of this branch forms an integral part of the teaching staff of the School of Applied Biology.

A number of graduate laboratory courses in the Nuclear Science and Engineering curricula were taught in the radioisotopes laboratory.

In addition, research programs are being conducted on the radiation chemistry of highly branched saturated hydrocarbons and cyanogen-hydrocarbon systems. Isotope separations under study are the isolation of individual Group II elements from reactor waste streams and the enrichment of natural calcium in the isotope calcium-46. The stable



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calcium-46 isotope is the only source of radioactive calcium-47, used extensively in medical research. Of the personnel on these projects, one is working toward the Ph.D. and one toward the M.S. in chemical engineering, two toward the M.S. and one toward the B.S. in chemistry.

Work with finely divided materials served as the unifying element in the micromeritics branch research. Great diversity has continued in the various projects. Studies have involved freezing of supercooled water droplets, effects of ionizing radiation on clay particles, association of gases and particles in smog-producing situations, the surface energy of crystals, surface area of particle masses, thermal conductivity of powders and powder mixtures, thermal force on airborne particles, evaluation of thermal force for collecting dust particles at altitudes of 10 to 20 miles, gas cleaning, and particle classification according to size. A notable project in the branch will contribute to the space research effort. It is aimed primarily at providing closely sized particles size distribution to be used in development of paint for controlling surface temperatures of space craft. Of the staff of 14, six are graduate students working toward the Ph.D. degree and two toward the M.S. degree in chemical engineering.



The industrial products branch made considerable progress in techniques of microminiaturization of electronic and solid state circuitry. A breakthrough was achieved in the industrial production of oil-free vegetable proteins for in-

dustry. The branch handled a large number of requests for information on chemical problems from individuals and industrial concerns throughout Georgia. Frequent consultations were held with Georgia Tech personnel for advice on information concerning industrial chemical products.

In the sanitary engineering research section, 20 of the 28 people on the total staff are undergraduate or graduate students. Six are working on M.S. degrees and three on the Ph.D. The phase of the program in radiological health is proving especially valuable and in many aspects is closely related to Civil Engineering graduate courses.

Other achievements worthy of mention in the Chemical Sciences Division include a three-fold increase in fresh water production from solar distillation with simultaneous reduction of ultimate cost, and completion of a major portion of a detection system for alpha, beta, gamma and neutron radiations in the environment which should aid studies for the establishment of parameters for background radiation measurements.

The division cooperated with the School of Chemistry in setting up a well equipped glass blowing shop and with the School of Chemical Engineering in forming a program in low temperature chemistry.



Frederick Bellinger, chief

MATERIAL SCIENCES

SOME NOTABLE ACHIEVEMENTS were realized in the Material Sciences Division over the past year, particularly in Ceramics Branch activities, but overall work increased little. This was due largely to delays in relocating the ceramics branch in more adequate leased space and in establishing a minerals preparation laboratory. With this facility now available, the division is in a much stronger position to offer services to industry.

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The anticipated growth of geologic research was not realized, but new work in seismology and earth's magnetic field is imminent. A division-sponsored visit to industries in the South resulted in donations of geologic equipment to Tech's Geology Department.

Notable achievements in the ceramic branch include development of an effective and inexpensive powder feed system for arc plasma jet spraying, a new technique for arc plasma jet spraying into substrates heated to 2,000 degrees, development of apparatus and techniques for rapidly determining porosity of ceramic specimens, development of furnaces and techniques for vacuum and inert atmosphere differential thermal analysis, and work with rebonded fused silica for an industrial concern which led to the development of brazing fixtures for fabricating stainless steel honeycomb panels for B-70 bombers.

Ceramics work is primarily supported by the Department of Defense and U. S. Atomic Energy Commission. Many student assistants were employed and the experience provided them training which fills a very real need in rounding out their engineering education.

In the minerals engineering group, major literature research on relationship of transverse geological structures in



the Southeast was completed. It will be useful in interpreting structural anomalies and important in water resources work, mineral studies, beach control and to the field of geology in general. Preliminary investigations of economic minerals were made in Lumpkin, Haralson and DeKalb counties with further investigations of lime resources in Thomas County. This work may lead to new mineral industries in the State. Markets for lime, white cement, mortar mix and granite by-products were studied. These studies are of immediate and future use to the sponsoring industry.

Preliminary work was done on mineral preparation in the new mineral preparation laboratory. This facility should permit major contributions to more complete utilization of Georgia's mineral resources and their share in the State's economy. Here again, contributions of equipment from industry have helped broaden the capacity of this effort.

Other general areas of research included work on causes of built-up roofing failures, causes of efflorescence in concrete block, optical, electron and X-ray microscopy studies for the kaolin industry, diffusion of gases through crystalline ceramics, effect of irradiation of kaolinites and relation between alloy structures and progression of electron bonding forces.



Thomas W. Jackson, chief

MECHANICAL SCIENCES

STRONG RESEARCH divisional programs were carried out during the past year in the Aeronautical, Mechanical and Civil Engineering Schools.

In Mechanical Engineering, research on the effects of sound on heat transfer and fluid flow, the use of hydroclone separators and viscosity determination were in progress. Work on helicopter theory, ducted propellers and wind tunnel projects made up the bulk of research in Aeronautical Engineering. Civil Engineering research included work on dam spillways, soil-cement, asphalt, lightweight concrete beams, stresses in layered pavements, piles and traffic flow.

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Important work, running now for a period of ten years, is the hydraulic research program in which Georgia Tech and the U. S. Geological Survey collaborate. Collaboration includes four major areas: (1) Discharge characteristics of embankment-shaped weirs; (2) Flow of water over weirs and spillways; (3) Uniform turbulent flow in open channels; and (4) Influence of free-surface disturbances on piezometric measurements.

Work completed on discharge characteristics of embankment-shaped weirs is believed to comprise an important contribution to knowledge of open-channel flows involving partially-developed boundary layers. The studies on flow over weirs involved application of analytical techniques to an area of hydraulic engineering which heretofore has been almost entirely empirical. Results of systematic and basic investigation of uniform, turbulent flow with a free surface comprised a substantial contribution to the understanding of fundamental mechanics of turbulent motion. Results of the piezometric study reveal need for carefully reviewing the practice of using piezometers for depth determinations in shallow, high velocity or disturbed open-channel flow. Outstanding in benefits from the project are contributions to knowledge and literature of hydraulic engineering which



have resulted.

There was other important work last year in Civil Engineering dealing mostly in the area of materials such as soil cement and soil with admixtures, bituminous mix design with laboratory and field studies, and concrete products problems. These projects resulted in considerable savings to industry in road construction methods and use of materials. One very beneficial project had as its objective the study of the economy and practicality of treating various types of soils with Portland cement and other admixtures to obtain stability. Nine typical soils were selected and evaluation of the testing program with soil and Portland cement resulted in development of a design procedure which was adopted by the Georgia State Highway Department. Results from these procedures permitted savings of thousands of dollars during the past year. Use of a bituminous material as an admixture with the same soils has also resulted in a design procedure.

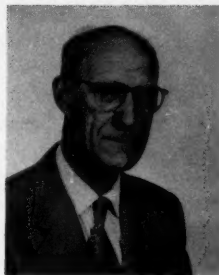
Another project started during the year was organized to determine criteria and ramp spacing on urban freeways based on traffic operation and economic considerations. Preliminary data on operation of the Atlanta Expressway and associated city streets has been collected as part of

the expressway study. Time and motion study movie cameras, analyst projectors, speed meters, volume counters and test vehicles to make travel time studies were used in the work. The information obtained will help develop criteria to determine spacing of ramps so as to better serve needs of urban auto transportation and provide efficient and economical movement of traffic.

Work continued under the sponsorship of the Defense Department on contributions to the field of mine countermeasures. In another project sponsored by the Department of Defense, a labyrinthine stimulator capable of constant angular accelerations over a range of 3,000 to 1 was developed. This device provides unique facilities for medical research in the study of response of humans to constant angular accelerations. A second such device is now under development.

Reports on the research of the effects of sound on heat transfer and the research on stresses in layered pavements were presented at professional meetings of international scope.

The projects described above not only contributed to basic knowledge but also provided graduate students with the opportunity to obtain advanced degrees.



Arthur L. Bennett, chief

PHYSICAL SCIENCES

BASIC RESEARCH in areas of physics which were receiving minor attention just three years ago now make up a substantial portion of work in the Physical Sciences Division. These long-neglected areas are solid state physics, molecular and ionic physics, upper atmosphere physics and nuclear physics.

The solid state physics group is continuing a survey of the field of solid state phenomena and summarizing new information for the Air Force and for a forthcoming book. Substantial progress in fabrication of research equipment in

the high vacuum, magnetics and solid state electronics laboratories has been achieved. Emphasis is being placed on building a broad research program.

Under investigation are thin films of ferro-magnetic materials, the magnetic behavior of a thin film at the interface with a dielectric or oxide coating and measurement of the magnetic susceptibility of various substances combined with work on specific heats. In related electronics studies, work is planned on measurement of the hysteresis loop of a magnetic film in the ultra high vacuum chamber where it is formed. Apparatus for studies of the oxidation of magnetic materials in the vicinity of the curie point is being developed. The versatile high vacuum laboratory is essential to the program. Pressures in the 10^{-9} Torr range are available for preparation of films, including alloys and multi-layers, under newly attained freedom from contamination.

The well-staffed and equipped diffraction laboratory with X-ray and electron diffraction measurement and interpretation skills, carries on a research program and provides essential service to many activities. The electron and optical microscopy laboratory operates similarly.

Work in molecular and ionic physics encompasses two



projects. In the first, cross sections for ionization of gases by fast protons are being measured in the previously unexplored high-energy region. Considerable interest has been aroused by these measurements and some of the data has been published in two new books. The results are needed for thermonuclear experiments, upper atmosphere study and astrophysics. The second project deals with ion-molecule reactions at thermal energy. For the first time in work of this nature the reacting species are positively identified by a mass spectrometer analysis of the drifting particles. Results are of theoretical interest and can be applied to the study of plasma.

The upper atmospheric research group has participated in 50 rocket firings in which artificial "clouds" of atomic sodium and cesium and metal powder were created between altitudes of 60 to 160 km. Instruments were fabricated to equip five widely separated sites from which to observe these clouds. Motion and still photographs are being analyzed for wind velocity, diffusion, spectral characteristics, shock wave phenomenon and turbulence.

In nuclear physics, theoretical work on internal conversion coefficients is progressing.

Activities in several areas of applied physics have con-

tinued vigorously. Areas included are the measurement of properties and structures of thin films, development of highly stable quartz crystal resonators, meteor communications, analog computer techniques and operations research.

In thin films, resistors with negligible temperature coefficient have been developed which operate up to temperatures of 1200°C with correspondingly high power dissipation. Significant progress on plastic and metal film coatings for control of infrared reflectance and emissivity has been made.

In conjunction with evaluation of current commercially available crystals, methods for the fabrication of quartz crystal resonators of superior performance have been developed. Low aging rates of a few parts in 10^7 per year for 100 mc resonators has been achieved consistently.

Analog computer laboratory research is leading toward development of new or improved components, techniques and applications. Design and construction of an experimental induction-type resolver has been essentially completed and tests will be undertaken shortly. Experiments were carried out to demonstrate the feasibility of a "generalized integrator." An inexpensive high quality FM modulator and demodulator system has been built to permit re-

cording of low frequency data on a standard AM tape unit. An improved six-channel voltage comparator utilizing tunnel diodes has been built to provide increased computational accuracy. The techniques of the analog computer staff have been applied effectively for the development of new instruments for physiological measurements by the medical staff at Emory.

During the fifth year in research on meteor communications, reports on observations of a number of meteor showers, a study of meteor radiants and the effects of transmission-path parameters have been published.

Work on measurement of radio meteors by forward scatter of UHF radio signals began in 1955, and basic studies have provided experimental measurements confirming theoretical advances in prediction of meteor rates. The evaluation of the practicability of meteor propagation communication depends on the availability of this information. Current publications provide accessible information for the effective utilization of both sporadic and shower meteors for communication links.

Assistance to the Bureau of Ships in the administration of a research and development program has been provided by evaluation of proposals and of work in progress.



Maurice W. Long, chief

ELECTRONICS

THE MOST CHALLENGING work of the Electronics Division has been associated with national defense and exploration of space. Nearly all the division's work is supported by, and consequently oriented to the needs of the Defense Department. Recent developments on programs within the communications and radar branches may prove useful to civilian activities by improving aircraft communications systems and by leading to more precise radar control of aircraft position. Studies of the microwave spectra of certain molecules helped to point out an anomalous behavior of molecules with three identical quadrupolar nuclei. Results are to be published soon on experimental acoustic-radio interaction in liquids.

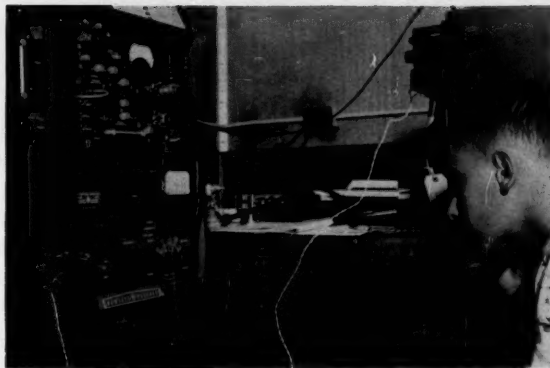
The communications branch performed research in communications techniques, systems and components and specifically in areas of radio frequency interference analysis and suppression techniques, speech intelligibility evaluation, solid state VHF and UHF frequency control devices and detection of ionospheric disturbances.

A solid state amplifier system was conceived to be incorporated in a receiving antenna which could be competitive from both a commercial and a performance standpoint with the vacuum tube systems recently introduced.

The branch is working with Armour Research Foundation on a large program directed toward development of the Department of Defense Radio Frequency Compatibility Analysis Center. Effort is being devoted to propagation models, receiver models, transmitter models, communications equipment interference fixes and optimal frequency selection methods for utilization by digital computers.

Further progress was made in a program to develop improved electronic techniques for determining speech intelligibility. A statistical analysis of articulation team test results permitted establishment of standard procedures which greatly strengthened confidence in precision of results.

The radar branch has been engaged in research in micro-



wave and millimeterwave antennas and components, low-level signal detection techniques, microwave propagation, radar target reflection properties, detection of targets in the presence of noise and clutter and principles and applications of radar systems. A substantial portion of research has been directed toward development of narrow beam, rapid scanning, precision radar systems. Development of improved radar systems is essential to the national defense effort.

Tech continues to be a recognized leader in microwave antenna research. New advances were made in the design and fabrication of highly directional geodesic Luneberg lens antennas capable of unusually rapid scan rates, and in methods of calculating geodesic lens surfaces. Basic improvements also were noted in multiple-reflector rotating antennas and wave-guide ring switches.

Several academic departments were assisted in selection, operation and maintenance of electronic instruments affording assistance to graduate thesis programs, laboratories of instruction, and research.

In the special techniques group, work was focused on some of the virtually unexplored electronic phenomena that have promise of eventually being applicable to nationally recognized programs of the communications and radar branches. Subjects under investigation include antennas, filters and detectors for submillimeter wave region (a virtually unexplored region of the radio spectrum), radio emission from the sun and atmospheric attenuation for submillimeter waves, noise and noise mechanisms in crystal diodes and barretters, microwave resonance phenomena of molecules and effects of acoustic waves on the radio-frequency characteristics of liquids.

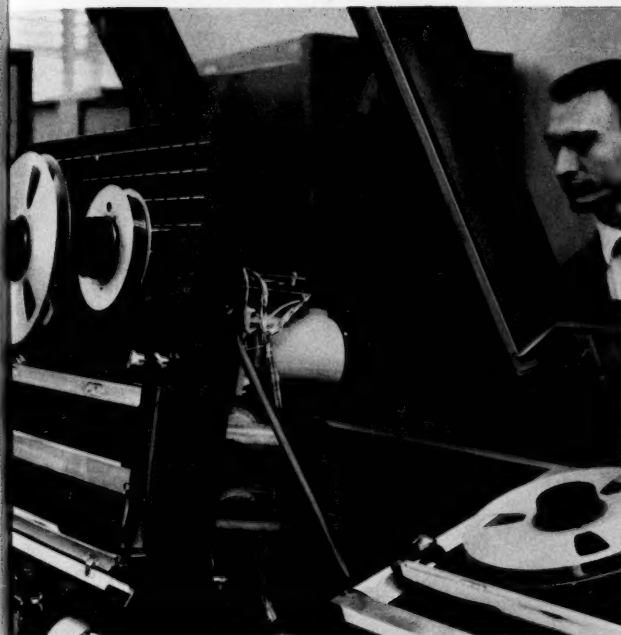


William F. Atchison, head

COMPUTER CENTER

RESEARCH at Rich Electronic Computer Center was on the increase during the past year.

The most active projects, supported by the National Science Foundation, have been the development of a com-



piller for the UNIVAC Scientific (ERA 1101), the addition of card input-output in the 1101, business simulation, machine translation of German into English, coulomb effects in beta decay, ternary equilibrium and many particle systems in quantum statistical mechanics.

Research continued on the receiver-transmitter interference problem jointly with the communications branch of the Electronics Division. It is an area where potential exists for many new developments. Techniques developed in these studies are applicable in many other areas, particularly in scheduling. Ideas from this work have been used in the football seat allocation program being developed in the computer center and in the scheduling of courses. They could clearly be used in more general school registration problems.

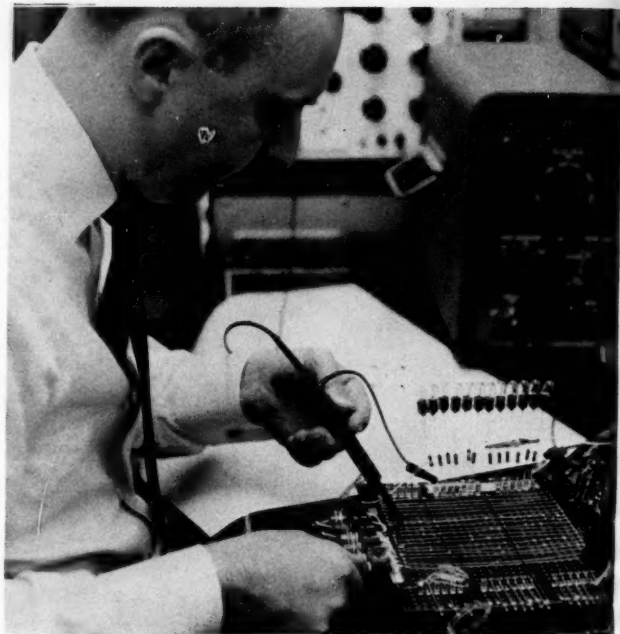
Research work has been continued on the computation of orbits of satellites. Recently, the emphasis has been on the development of a near-earth satellite orbit computation program, using oblate spheroidal coordinates.

The statistical analysis group has been working on the application of Stochastic Process theory and the statistical aspects of interference and microwave propagation.

New languages for computers have greatly facilitated

the use of computers. The two principal problem-orientated computer languages have been COBOL (COMMON Business Orientated Language) and ALGOL (ALGORithmic Language). The first of these is being developed primarily for data-processing and business problems. The second, which has reached a higher state of development, was constructed to handle scientific and engineering problems. One version of the ALGOL has been in use in the computer center for over a year now. During this past year, it has changed the center's entire operation. Literally speaking, many problems which used to take months of preparation before they could be successfully processed on a computer can now be done in a matter of days. This means that the computer is now an even more useful research tool than before.

Relative to the Atlanta area, Tech is no longer one of the three or four places with computers. There are, or very soon will be, in the neighborhood of 100 digital computers in the Greater Atlanta area. Thus, the computer center now has an increased responsibility to provide training on computers for its students. It means also that the probability of Tech having to provide computer services for the local community has been greatly reduced.



A group which has consistently utilized the center is the Testing and Guidance Group under Dr. John R. Hills from the Board of Regents of the University System of Georgia. They use the computers to carry out various statistical studies necessary in their work.

A group from Southern Bell Telephone and Telegraph Company came to the center with one of their problems. A short preliminary study was made of underlying patterns of equipment malfunctions in the Bell Telephone System which enabled the company to initiate an inter-company project for reducing this type of malfunction.

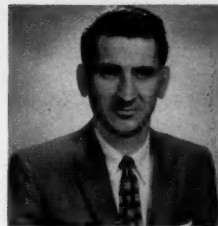
Several projects involve advisory services to Georgians. Notable among these was work with the Georgia Power Company which involved considerable consultation. Assistance was increased greatly by the special course on computers offered for the Georgia Power Company at the center.

Thirty-four thesis and faculty research projects employed the use of computers. All divisions of the Engineering Experiment Station used the facilities of the center. Also, of particular significance was the use of the center by people doing testing and guidance work here on the campus.

Kenneth C. Wagner, head

INDUSTRIAL

DEVELOPMENT



THE INDUSTRIAL DEVELOPMENT BRANCH has gained wide recognition as the state's authority on matters relating to industrial development and its progress.

Two new sections were established in the past year bringing the total to four. They are: community and area development, industrial locations, industrial economic and manpower and management.

Tech's industrial development staff increased from 29 to 40.

A major analysis of what has happened to industrial development in Georgia since 1947 was completed by the branch during the year, showing Georgia's progress as

compared with other Southeastern States and the U. S. It points up problems which need to be resolved if Georgia is to achieve her full potentials, and outlines goals which provide a framework for the state's development efforts in years ahead.

The branch's program of technical assistance to local and state development agencies, and to small manufacturers was greatly expanded. Technical information and assistance in the evaluation of industrial sites and other development problems were provided to local groups. Market data, resource information, and labor data were provided to state agencies. A wide range of technical help was provided a variety of manufacturing firms.

Of special significance was the initiation during the year of a "model" or "demonstration" town project, which resulted in the selection of Moultrie and Sandersville as the first two communities in the state as subjects of intensive study and technical assistance. Undertaken as a three-to-five-year program, the project is intended to carry the participating communities through a full scale development program, from the auditing of local resources to the securing of their first new industrial payrolls. A major goal, in addition to providing a demonstration of what might be

done elsewhere in the state, is to generate new centers of healthy economic growth.

Special manpower studies were expanded, including a study of the "formula" employed by a particular firm to avoid labor difficulties and to secure a highly productive work force and a special study on unionism in Georgia. An analysis of what has happened to high school graduates in a sample of counties also was undertaken. It will present information on the types of jobs secured, the availability of suitable employment in home areas, and the correlation between the training received in high school and the types of employment open.

Basic studies included the completion of a completely new directory of Georgia Manufacturers and extensive on a volume on Georgia's mineral resources. A special report on Georgia's water resources was begun during the year.

An atlas of Georgia industry was also started. Its purpose is to supplement the directory by providing graphic and written materials on the concentration of various types of manufacturing in the state and their significance in the Southeast and in the U. S.

The largest single project completed during the year was

GEORGIA TECH Works for Georgia

Special Industry Studies

CHEMICALS

PLASTIC PIPE



WOOD PRODUCTS



METAL PRODUCTS



GENERAL



Research Gets Results

This report



Brought this



Cost \$8,340

Estimate of 10 year tax return:
\$4,400,000 from this one study.

Community Development





the series of special industry studies carried out for the U. S. Southeast River Basins Study Commission. An intensive follow up of earlier work for the Commission involved an overall analysis of the economy of the study area, with projections to the year 2000. Chemicals, pulp and paper, metal and plastic fabrication, electrical and non-electrical machinery, transportation equipment, wood products and textiles were the major industry categories analyzed in detail.

By carrying a program of research and technical assistance to communities throughout the state and to an in-

creasing number of small manufacturers as well, the branch is, for the first time, bringing Georgia Tech to many cities and individuals who heretofore have known little about the Institute. Each time an industrial development staff member does an effective job with a local development agency or industry, he generates interest and support for the school. Ultimately, one result may be an increasing amount of financial support for Tech from industry and from the legislature.

By bringing new payrolls to the state, Tech has caused a large amount of new tax revenues to be generated. It has started a program which should ultimately result in much more effective utilization of natural, man-made and human resources. The development of Brunswick's port potentials is a case in point. Former Gov. Marvin Griffin allocated funds for the construction of state docks on the basis of IDB's port potentials study. Bestwall Manufacturing Company's multi-million dollar plant subsequently came to Brunswick as a result of an analysis which IDB staff members made of the suitability of Brunswick as a location for its plant. Through such results, the Station's industrial development program is helping to more fully develop the state's economic potentials.



Robert J. Kyle, head

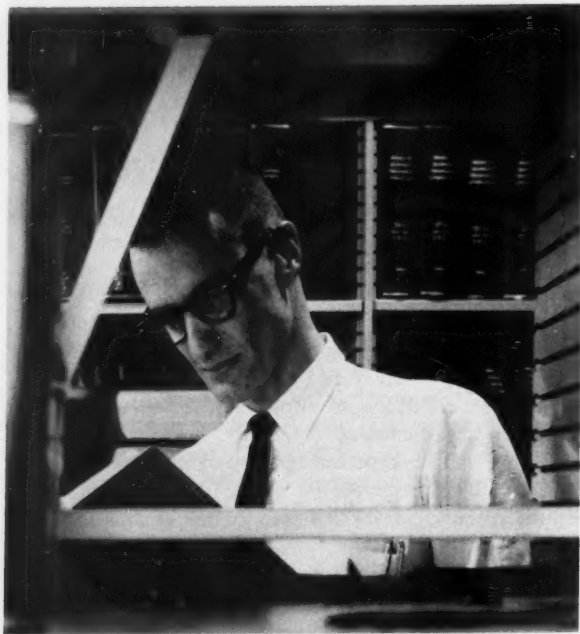
TECHNICAL INFORMATION

THE TECHNICAL INFORMATION SECTION continued to fulfill its three basic responsibilities—to provide the literature services needed by the research programs of the campus, to conduct research and development programs on

information handling, and to provide facilities for editing and typing research reports.

The primary activities of the office included the development of a program for study of the training of specialists for technical libraries; the compilation of electrical and mechanical data on all types of military antennas; a survey of the literature of engineering education; a survey of literature on the shape of the earth; a survey of textile machinery for the early stages of yarn preparation; a study of citations used in Russian chemical literature; a survey of literature of the failure of asphalt roofing; a survey of the literature on the economics of Southeastern chemical industry; a survey of the literature on high-pressure solubility; a study of the literature on controlled electrical stimulation of muscles; and the collection of information on relays from all U. S. relay manufacturers.

Minor activities, expected to expand in scope, included a study of letter structure of words for use by automatic machine readers, library and information economics, manuals for industries in underdeveloped areas, ionizing radiation for embalming, frost protection of peach trees by infrared radiation, detection of library book thefts, two-phase



flow correlations, a portable book copying device, and superconducting magnet coils.

A series of antenna catalogs, a cooperative project with the Electronics Division, hold promise of saving the country possibly millions of dollars by reducing the duplication of design effort on military antennas. The use of the catalogs will reduce delays in providing equipment for the Armed Forces, thus providing an important defense aid.

The technical information staff filled 50 requests for technical assistance, varying from queries about the prevention of moisture in warehouses to propagation of bamboo and recommendation of consultants for insurance firms. Nearly 700 photoduplicates of technical references were provided to Georgia and other Southern companies. Also, a number of technical translations were provided.

As an interdepartmental activity, the section has been working with the library staff in preparing research proposals on citation surveys and on training of library personnel for technical libraries. The weekly machine translation seminars are another interdepartmental activity.

TIS has provided forms, services, and advice on various literature search and translation problems, and the report section has provided editing, typing and proofing services.



Harry L. Baker, Jr., pres.

RESEARCH
INSTITUTE

The Georgia Tech Research Institute, a non-profit Georgia corporation, functions for the purpose of promoting research and industry in Georgia in cooperation with the Georgia Institute of Technology.

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As the major contracting agency, it handled 305 proposals during the year which resulted in 184 contracts or contract extensions providing additional funds for research. It also administered the invention activity and patents resulting from Station research.

The Institute assisted in the promotion of Georgia Tech research programs by helping maintain outside interest and support and by the submission of information relative to research capabilities prior to the proposal stage. Through its efforts distinguished foreign scientists were brought to Tech. It continued to make funds available for the furtherance of research on the campus.

Officers of the Georgia Tech Research Institute are Fuller E. Callaway, Jr., chairman of the board; Frederick G. Storey, vice chairman; Harry L. Baker, Jr., president; James E. Boyd, secretary and assistant treasurer; William B. Harrison, assistant secretary; Roy A. Martin, assistant secretary, and Paul Weber, treasurer.

Members of the Board of Trustees are James E. Boyd, Harllee Branch, Jr., Fuller E. Callaway, Jr., M. A. Ferst, Carlyle Fraser, Ben S. Gilmer, Edwin D. Harrison, Frederick G. Storey, Ray L. Sweigert, William B. Turner, Paul Weber and Robert H. White.

Stiemke Takes Station Helm



Robert E. Stiemke, the 46-year-old new director of Georgia Tech's Engineering Experiment Station, feels that Tech's future in research is a bright one.

"It will grow increasingly important," says the Milwaukee, Wisc., native, "not only to Georgia and the nation, but to Tech's graduate program and other phases of campus activity."

Stiemke, a former director of Tech's School of Civil Engineering who has succeeded Dr. James E. Boyd at the Station's helm, believes every effort must be applied to make the Station's work as meaningful as possible to academic work. "Research, not only here at the Station, but in the instructional departments should be coordinated for the greatest benefit to all."

The new director was educated at the University of Wisconsin where he received two civil engineering degrees. His engineering work includes service with the U. S. Army Corps of Engineers in the Milwaukee District, consulting engineering in the City of Detroit, U. S. Public Health Service, New York District, and miscellaneous consulting in

sanitary engineering while teaching.

Before joining Tech's staff in 1950, he taught at Wayne University in Detroit, North Carolina State College, and Pennsylvania State College. During part of his stay at N. C. State, Stiemke was also in charge of the school's engineering experiment station.

Stiemke has authored a number of scientific articles on a wide range of engineering topics. Among these are: "Stream Pollution—Your Professional Responsibility," *N. C. Engineer*; "Minimum Requirements for Sanitary Engineers," *Civil Engineering Bulletin*; and "Why Young Engineers Don't Want to Teach," *The American Engineer*. He is a member of 19 scientific and professional societies. Of these organizations, he has served as director of the American Sanitary Engineering Inter-Society Board since 1953; national director of the Water Pollution Control Federation from 1957 to 1960; president of the Georgia Engineering Society in 1956; and president of the Atlanta Post, Society of American Military Engineers, 1957. He is now serving on Governor Vandiver's Engineering Advisory Board.

He is listed in *Who's Who in America*, *Who's Who in Engineering*, *Who's Who in the Southeast*, *Who's Who in Education*, and *American Men of Science*.

On the personal side, the new director is a member of the Presbyterian Church, is married and has three children. He is something of a "globe-trotter," having toured the entire United States, parts of Canada, Mexico, 16 European countries visiting engineering schools, Caribbean Islands and South America as a delegate to the Pan American Congress on Engineering Education in Buenos Aires. This past summer Stiemke visited Arctic Air Forces bases in Greenland, Canada and Alaska as guest of the Air Force Director of Civil Engineering.

Speaking of Station problems, Stiemke cited the lack of adequate space, a problem that he believes confronts the entire campus. He mentioned another institutional problem—lack of communications. "Everyone recognizes this problem," Stiemke said, "and everyone should make a conscientious effort to improve the situation."

Stiemke is "just beginning to get my feet on the ground," as far as Station operations are concerned. He has been meeting each afternoon with individual division heads in orientation sessions.

"I appreciate the help and good counseling I have received during this transition," Stiemke remarked, "and I am much impressed with the calibre of Station personnel."

EDITED IN RETROSPECT

WITH THIS ISSUE, *The Research Engineer*—official magazine of the Georgia Tech Engineering Experiment Station since May, 1946—changes in both concept and format. It has now become what is known in the trade as a “university magazine,” representing all of the Georgia Institute of Technology. Scattered throughout the magazine in the future the reader will find articles ranging from research in the teaching departments at Tech to literary efforts of members of the Georgia Tech faculty. For instance, the next issue of the magazine will be a special issue on “Solid State at Georgia Tech,” one of the true interdisciplinary efforts on today’s Tech campus. Research will still play the large role in the magazine, but don’t be surprised if you find an article on “The Business Growth of Georgia” or “The Consequences of Technology” in a future issue.

Robert B. Wallace, Jr.



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